Shuttle Small Payloads Project Office
1999 Symposium

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NASA Goddard Space Flight Center - Greenbelt

Agenda

- GSFC SSPPO Overview
- Summary Comparison of SSPPO Projects
- Mission Metrics
- Manifested Payloads
- Unmanifested Payloads
- Mission Highlights
- Future Enhancements

GSFC SSPPO Overview

Shuttle Small Payloads Project Office

- Background:
  - NASA's Goddard Space Flight Center (GSFC) Shuttle Small Payloads Project Office (SSPPO) executes the Hitchhiker, Hitchhiker-Jr., Get-Away-Special (GAS) and Space Experiment Module (SEM) Projects for NASA's Office of Space Flight.
  - Contacts:
    - Payload Carriers Program, Code VA-A, KSC
      Charles Sawyer, Jr., (407) 867-4840
    - Hitchhiker/GAS Program Coordination, Code MO, HQ
      Robert Elsbernd, (202) 358-2885
    - Shuttle Small Payloads Project Office, Code 870.G, GSFC - Greenbelt
      Chris Dunker, (301) 286-4271

Shuttle Small Payloads Project Office

- History:
  - Previous Symposium held at Camden Yards, Baltimore, Maryland, Sept 25-28, 1995
  - Since that time, the following changes have been made:
    - GSFC underwent a major reorganization
      - Shuttle Small Payloads Project was part of the Special Payloads Division in the Engineering Directorate
      - The Shuttle Small Payloads Project Office was established as part of the Suborbital and Special Orbital Projects Directorate, (Code 800), Wallops Flight Facility
    - Transfer of GAS/SEM from GSFC Greenbelt to GSFC WFF
      - Transition over approximately a two year period
      - Effective 10/1/99
      - WFF executes the GAS/SEM Programs while SSPPO at Greenbelt maintains HH and overall Project Management

- History:

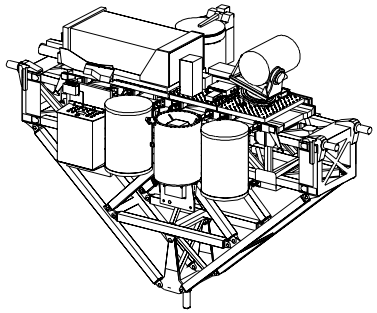
  - Transfer of GAS/SEM from GSFC Greenbelt to GSFC WFF (continued)
    - WFF Team Members include:
      - » David Wilcox -- GAS Mission Manager
      - » Chuck Brodell -- SEM Mission Manager
      - » Chuck Williams -- Lead GAS NTM
      - » Florence Patten -- Lead GAS Safety Officer
      - » Barbara Justice -- GAS & SEM Customer Contact

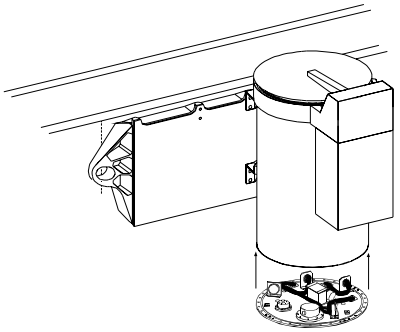
  - GSFC ISO 9001 Certification
    - Audit occurred August 23 - 27, 1999
    - Results: GSFC recommended for certification

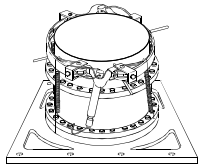
  - GAS Program Policy Revision
    - NASA Headquarters plans to revise GAS Program Policy to emphasize NASA Strategic Goals

Summary Comparison of SSPPO Projects

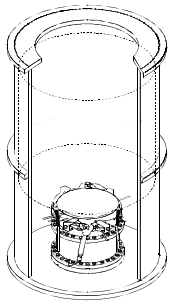
Comparison of Hitchhiker, Hitchhiker-Jr., GAS CAP and SEM Carrier Requirements







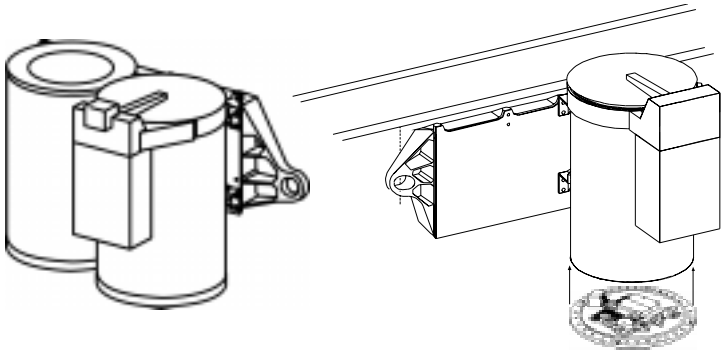
Pallet Configuration



Can Configuration

CAPABILITY	**HITCHHIKER**	**HITCHHIKER-JR**	**SEPARATION SYSTEMS** **HH Ejection System (HES)** **Pallet Ejection System (PES)**
Payload Category	Primary/Secondary	Secondary	Secondary
Max Customer Weight (lb.)	3000 total lbs.	200 lbs.	150 lbs.
Payload Mounting	Canister: 200 lbs. max; Side Plate: 305 lbs. max; Single Bay Pallet (SBP): 600 lbs. max; Double Bay Pallet (DBP): 600 lbs. max	Canister	HES: Canister (Door/No Door) PES: Canister (Door/No Door); Single Bay Pallet (SBP); Double Bay Pallet (DBP)
Subsystems	PWR, CMD/TLM HTR PWR	PWR, Limited CMD/TLM HTR PWR	No PWR, No CMD/TLM HTR PWR (Canister Walls)
Supplied Power (watts)	1500W	100W	No
Uplink Commands	Yes	No	No
Shuttle Downlink Data (max)	1200 baud / 1.4 Mb/s	No	No
Crew Control	Option	PGSC/BIA	Shuttle Standard Switch Panel
Crew Display	Option	Yes	Yes
Payload Unique Attitudes	Yes	Yes	Yes

Comparison of Hitchhiker, Hitchhiker-Jr., GAS CAP and SEM Carrier Requirements



CAPABILITY	**GAS**	**CAP**	**SEM**
Payload Category	Tertiary	Secondary	Tertiary
Max Customer Weight (lb)	200	200	6 per module 60 per payload
Payload Mounting	Canister	Canister	Modules (10 total)
Subsystems	No	No	Battery, Fuse Box, Support Structure
Supplied Power (watts)	No	No	600W
Uplink Commands	No	No	No
Downlink Data (max)	No	No	No
Crew Control	3 Relays (PGSC/BIA)	3 Relays (PGSC/BIA)	1 Relay (PGSC/BIA)
Crew Display	PGSC/BIA	PGSC/BIA	PGSC/BIA
Payload Unique Attitudes	No	Yes	No

Mission Metrics

Payloads Flown Since Last Symposium

- Payloads Flown Since Last Symposium (Sept 25-28, 1995) = 79

  – Hitchhiker

• GPP (GLO-4; PASDE-01)	STS-74	11/12/95
• SLA-01	STS-72	01/11/96
• TEAMS (VTRE; PAMS; LMTE; GANE)	STS-77	05/19/96
• CRYOFD	STS-83	04/04/97
• CRYOFD-R	STS-94	07/01/97
• TAS-01 (SLA-02; ISIR; TPF; SOLCON; CVX; COOLLAR)	STS-85	08/07/97
• IEH-2 (UVSTAR; GLO-5; GLO-6; SEH; DATA-CHASER)	STS-85	08/07/97
• LHP/NaSBE (LHP; NaSBE)	STS-87	11/19/97
• IEH-3 (UVSTAR; STARLITE; SEH; SOLCON-2; PANSAT)	STS-95	10/29/98
• CRYOTSU	STS-95	0/29/98
• MIGHTYSAT-1 (MIGHTYSAT-1; SAC-A)	STS-88	12/04/98
• STARSHINE	STS-96	05/27/99

Payloads Flown Since Last Symposium

- Payloads Flown Since Last Symposium (Sept 25-28, 1995)

  – HH-Jr./CAP

• TES-2	STS-72	01/11/96
• RFTPCE	STS-77	05/19/96
• SEM-01	STS-80	11/19/96
• SEM-02	STS-85	08/07/97
• SEEDS-II	STS-86	09/18/97
• SOLSE/TGDF	STS-87	11/19/97
• SVF-01	STS-90	04/17/98
• SEM-03/SEM-05 ISSPSP-1/ISSPSP-2	STS-91	06/02/98
• SEM-04	STS-95	10/29/98
• SEM-07	STS-88	12/04/98
• SVF-02	STS-96	05/27/99

Payloads Flown Since Last Symposium

- Payloads Flown Since Last Symposium (Sept 25-28, 1995)

  – GAS

• G342, G456, G740	STS-72	01/11/96
• G312	STS-76	03/22/96
• G056, G063, G142, G144, G163, G200, G490, G564, G565, G703, G741	STS-77	05/19/96
• G572, G745	STS-85	08/07/97
• G036	STS-87	11/19/97
• G093, G141, G145, G432	STS-89	01/22/98
• G744, G197, G772	STS-90	04/17/98
• G090, G743, G648, G765	STS-91	06/02/98
• G238, G779, G467, G764	STS-95	10/29/98
• G093R	STS-88	12/04/98

Manifested Payloads

(all but SEM-06/MARS still under review)

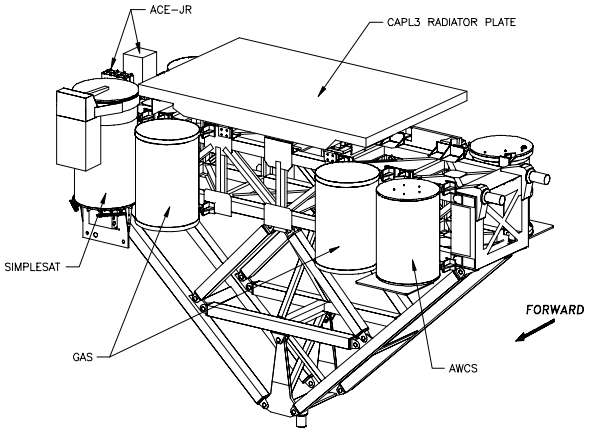
Manifested SSPP Hitchhiker Payloads

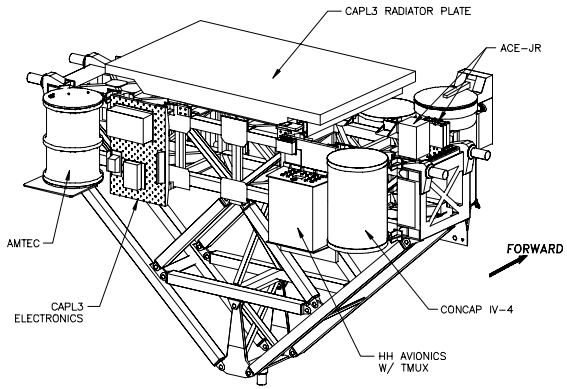
• SEM-06/MARS	STS-101	12/99
• HEAT (CAPL3; AMTEC-AWCS; SIMPLESAT; CONCAP-IV; ACE-Jr.; SEM/GAS)	STS-105	11/00
• TAS-04 (ISIS; TRIANA HST ASE)	STS-107	12/00
• MEIDEX	STS-107	12/00

HEAT

- HEAT: Hitchhiker Experiments Advancing Technology (HEAT)
  - Manifested on STS-105; Nov. 2000 launch

- The third flight of the Capillary Pumped Loop experiment (CAPL 3), managed by NASA/GSFC
- The Alkali Metal Thermal-to-Electric Converter and Automated Wafer Cartridge System (AMTEC/AWCS) payloads, managed by JPL.
- The Consortium for Materials Development in Space Complex Autonomous Payload IV (CONCAP IV-4), managed by the University of Alabama.
- The ejectable Simplesat satellite, managed by NASA/GSFC .
- The ACE-Jr, a demonstration of the Advanced Carrier Equipment (ACE) technology designed to replace the HH Avionics, managed by NASA/GSFC.
- Two GAS payloads.

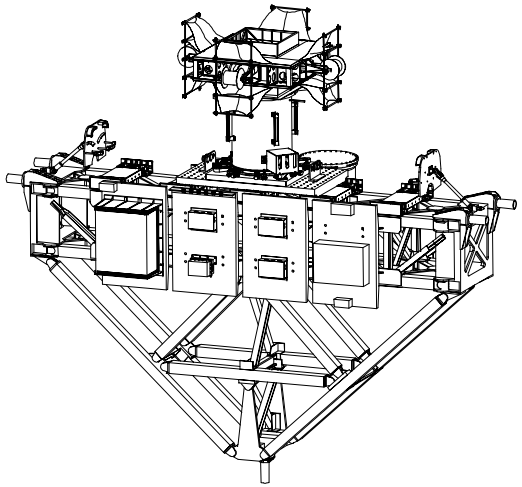




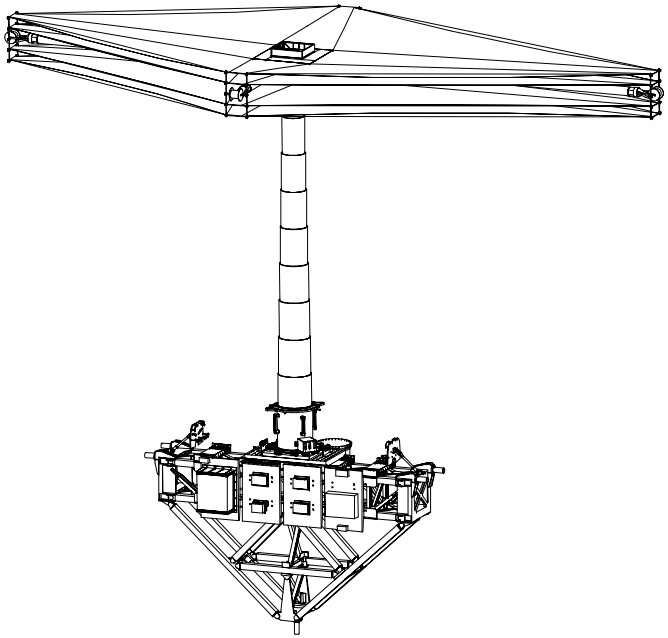
TAS-04

- TAS-04: Technology Applications and Science
  - Manifested on STS-107; Dec. 2000 launch

- NGST research flight of the Inflatable Sunshield in Space (ISIS), managed by NASA/GSFC.
- Mediterranean Israeli Dust Experiment (MEIDEX), co-sponsored via an International Agreement between NASA and Israeli Space Agency
  - Requires Israeli Astronaut Payload Specialist
- Additional Triana Airborne Support Equipment (ASE) mounted on two plates on the aft face of the MPESS (mechanical interfaces only)



Launch Configuration - View Looking Aft



Sunshield Fully Deployed Launch Configuration

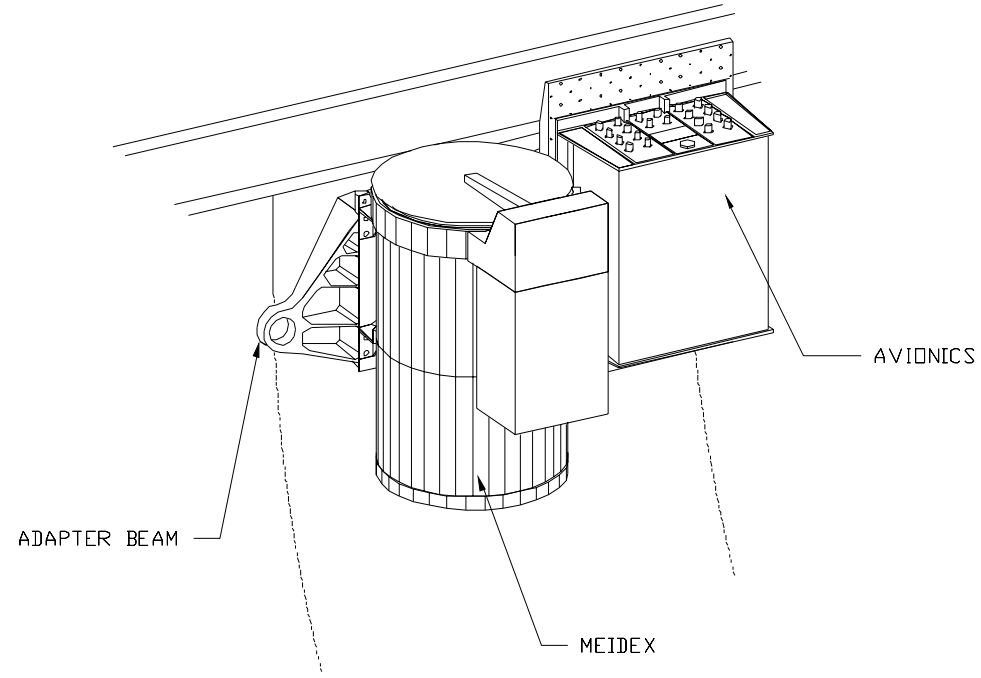
MEIDEX

MEIDEX: Mediterranean Israeli Dust Experiment

- Israeli Space Agency
  - Radiometric camera, functioning in the 300-860nm spectral region
  - Intended to investigate of the geographical variation of the optical, physical and chemical properties of desert aerosol.
  - Requires International Agreement between NASA and Israeli Space Agency
  - Requires Astronaut Payload Specialist

- Configuration includes:
  - One HMDA canister
  - One HH avionics unit

- Altitude and Inclination Constraints:
  - Minimum Inclination 38°
  - Not ISS Compatible



Unmanifested Payloads with Draft Payload Integration Plans

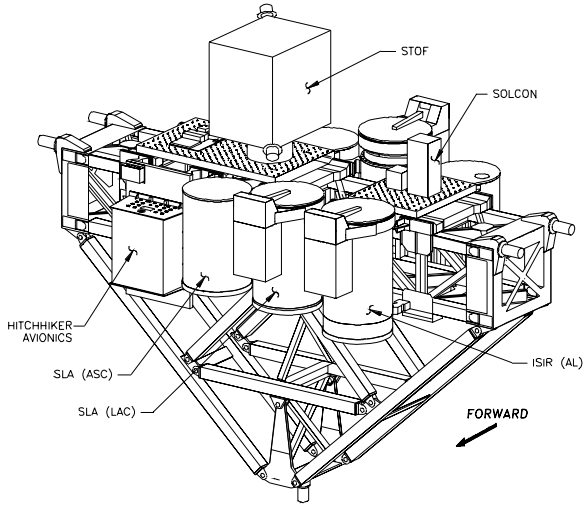
(Side-wall payloads listed according to HQ Priority Listing 8/99)

Unmanifested SSPP Hitchhiker Payloads

Cross-Bay:

- TAS-03: Technology Experiments Advancing Missions In Space
  - The third flight of the Solar Constant experiment (SOLCON-03), managed by the Royal Meteorological Institute of Belgium.
  - The second flight of the Infrared Spectral Imaging Radiometer (ISIR-02), managed by NASA/GSFC.
  - The third flight of the Shuttle Laser Altimeter (SLA-03), managed by NASA/GSFC.
  - The ejectable satellite Sloshsat Facility for Liquid Experimentation and Verification in Orbit (FLEVO), part of the Slosh Test Orbital Facility (STOF), managed by the ESA/ESTEC
  - The second flight of the Shuttle Ozone Limb Sounding Experiment (SOLSE-02), managed by NASA/GSFC Code 916
  - GAS Payload
  - SEM Payload

- Launch Ready - Mid 2000 (assumes L-10 manifest)
- Not ISS Compatible
  - Shuttle Resource, Timeline and Attitude Intensive

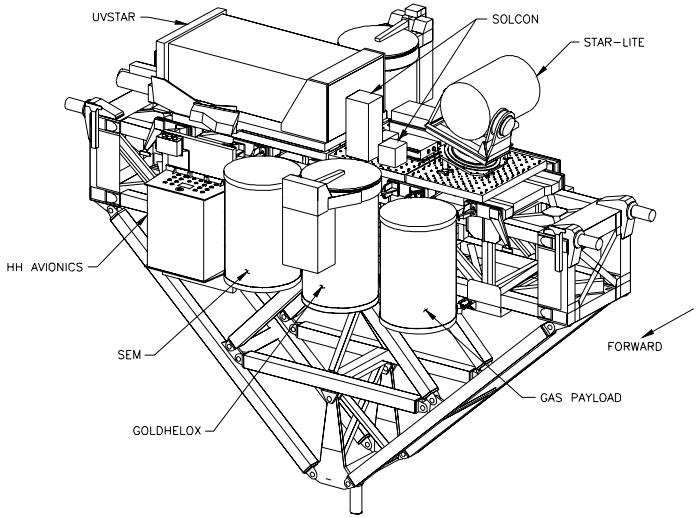


Unmanifested SSPP Hitchhiker Payloads

Cross-Bay:

- IEH-4: International Extreme Ultraviolet Hitchhiker
  - The fourth flight of the Solar Extreme Ultraviolet Hitchhiker (SEH), managed by University of Southern California.
  - The fourth flight of the Ultraviolet Spectrograph Telescope for Astronomical Research (UVSTAR), managed by University of Arizona.
  - The second flight of the Spectrograph Telescope for Astronomical Research (STAR-LITE), managed by the University of Arizona.
  - The third flight of the Solar Constant Experiment (SOLCON), managed by the Royal Meteorological Institute of Belgium.
  - Golden Heliocentric Observation Experiment (GOLDHELOX), managed by Brigham Young University.
  - GAS Payload
  - SEM Payload

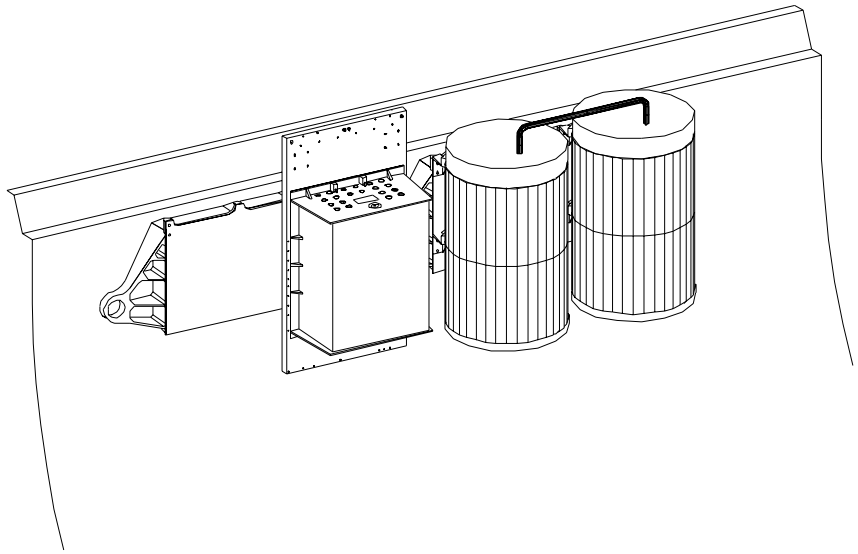
- Launch Ready - Mid 2000 (assumes L-10 manifest)
- Not ISS Compatible
  - Shuttle Resource, Timeline and Attitude Intensive



Unmanifested SSPP Hitchhiker Payloads

Side-Wall:

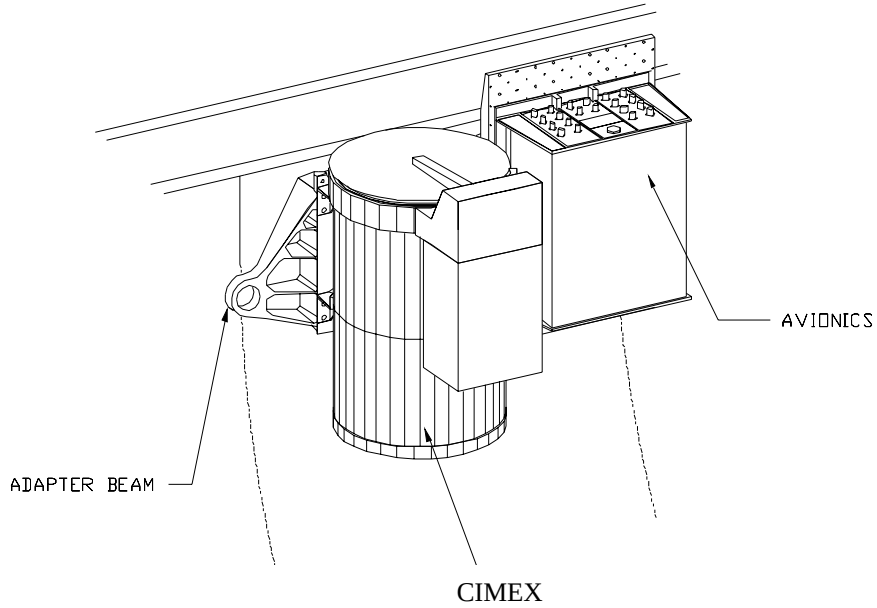
- CVX: Critical Viscosity of Xenon
  - The second flight of the Critical Viscosity of Xenon experiment sponsored by the NASA Glenn Research Center and the National Institute of Standards and Technology (NIST)
    - Experiment designed to measure the viscosity and shear rate dependence of Xenon at temperatures very near its liquid-vapor Critical Temperature (T_c = 16.7° C, 62 ° F)
  - Launch Ready - Early/Mid 2000 (assumes L-9 manifest)
  - Not ISS Compatible



Unmanifested SSPP Hitchhiker Payloads

Side-Wall:

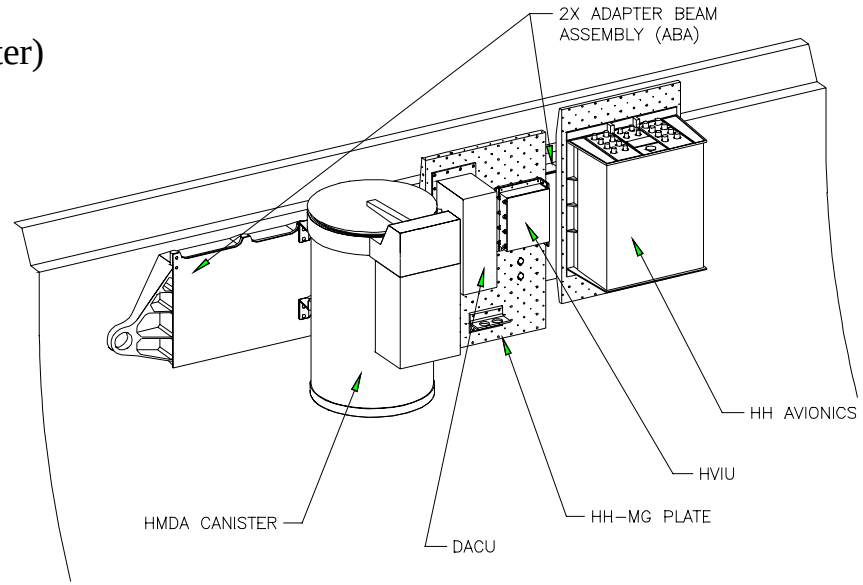
- CIMEX: CCD Imaging Experiment, Managed by INPE.
  - Launch Ready - Late 2001 (assumes L-9 manifest)
  - Not ISS Compatible



Unmanifested SSPP Hitchhiker Payloads

Side-Wall:

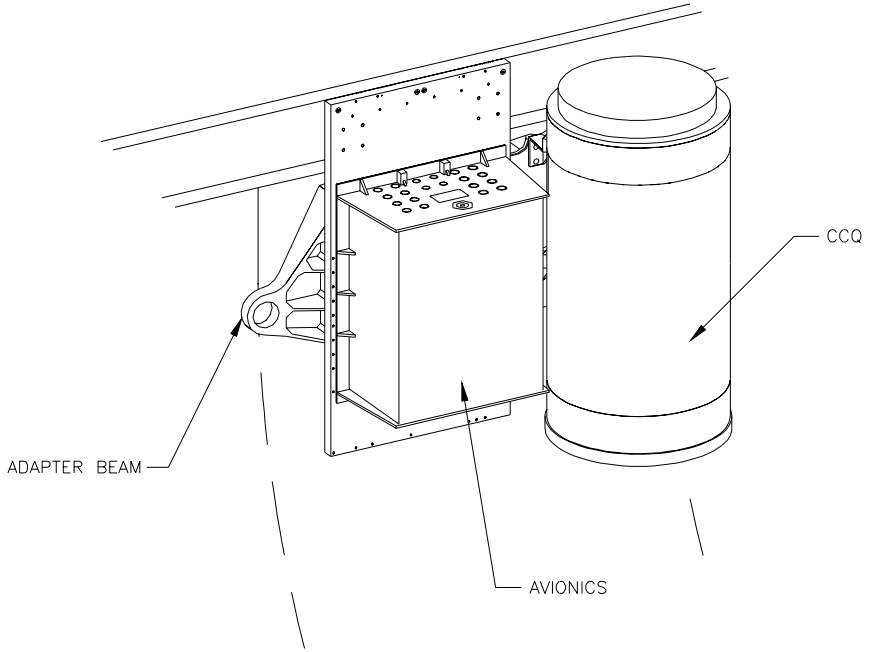
- ACSBIRS: Active Cleaning for SBIRS-Low (ACSBIRS)
  - USAF Research Laboratory/DOD Space Test Program technology demonstration platform
    - Intended to demonstrate that active CO_2 jet spray cleaning technology can be used as a particulate contamination removal technology in a space environment.
    - Representative of the SBIRS Low Flight Demonstration System Track Sensor design
  - Launch Ready - Late 2000 (assumes L-9 manifest)
  - ISS Compatible
    - Cannot exceed 80°C (internal to canister)



Unmanifested SSPP Hitchhiker Payloads

Side-Wall:

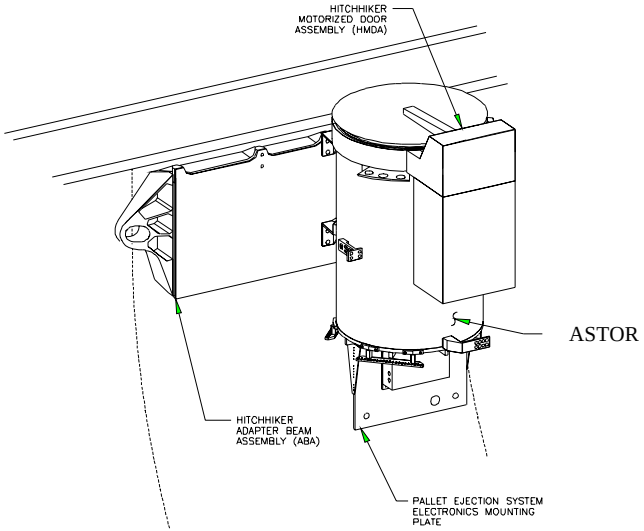
- CCQ: EOS Chemistry CPL Qualification Flight, managed by NASA/Goddard Space Flight Center, Code 545
  - Micro-gravity demonstration of a two-phase flow thermal control system.
  - Follow on to the Two Phase Flow Experiment, flown on STS-85.
  - Launch Ready - Early/Mid 2000 (assumes L-9 manifest)
  - Not ISS Compatible



Unmanifested SSPP Hitchhiker Payloads

Side-Wall:

- ASTOR: Advanced Safety Tether Operations and Reliability Satellite, managed by Marshall Space Flight Center and Michigan Technic Corporation
  - Primary objective is to test and flight qualify the Emergency Tether Deployer (ETD) system as a hazard control system and as a primary deployer system.
  - Secondary objectives include:
    - data acquisition of spacecraft temperatures and the UV flux from the sun
    - foster interest and permit active participation of pre-engineering students in space activities.
  - After deployment ASTOR will separate into two satellites connected by a tether 2.5 km in length.
  - Launch Ready - Early 2002 (assumes L-9 manifest)
  - ISS Compatible



Unmanifested Payloads
with Signed 1628

Unmanifested SSPP Hitchhiker Payloads

- HQ Priority Listed:
  - ISIR-03 (HQ Priority #21 as of 8/99)

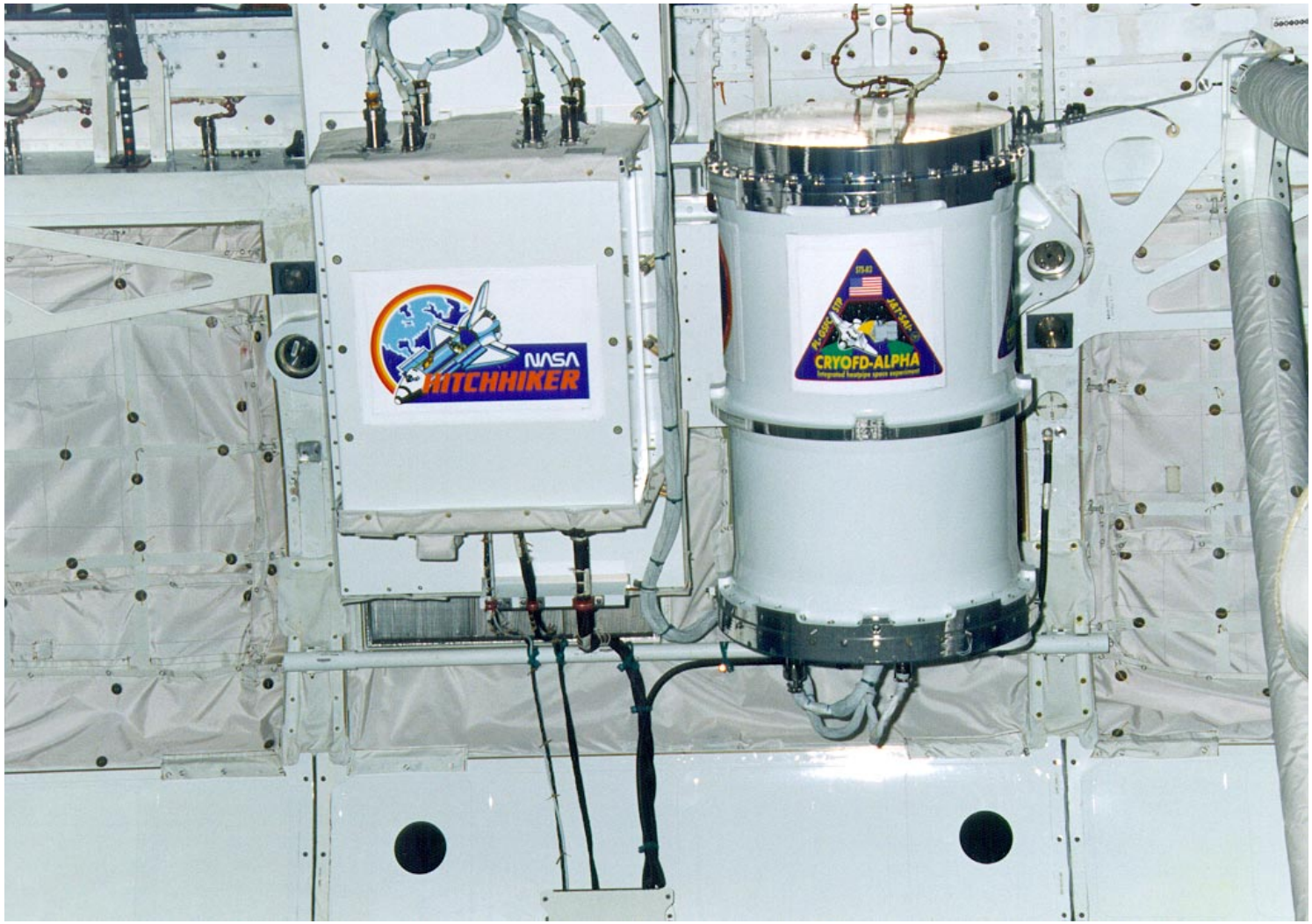
- Non-HQ Priority Listed:
  - MINERVA-1
  - SPASE
  - VULCAN-01, -02, -03
  - CONCAP IV-05
  - CONCAP III-02, -03, -04
  - SLA-04
  - IEH-05
  - HRSGS
  - NGST-P1

- Payload queue is ready for manifest opportunities

Mission Highlights

TEAMS, STS-77, May 19, 1996

CRYOFD-ALPHA, STS-83, April 4, 1997



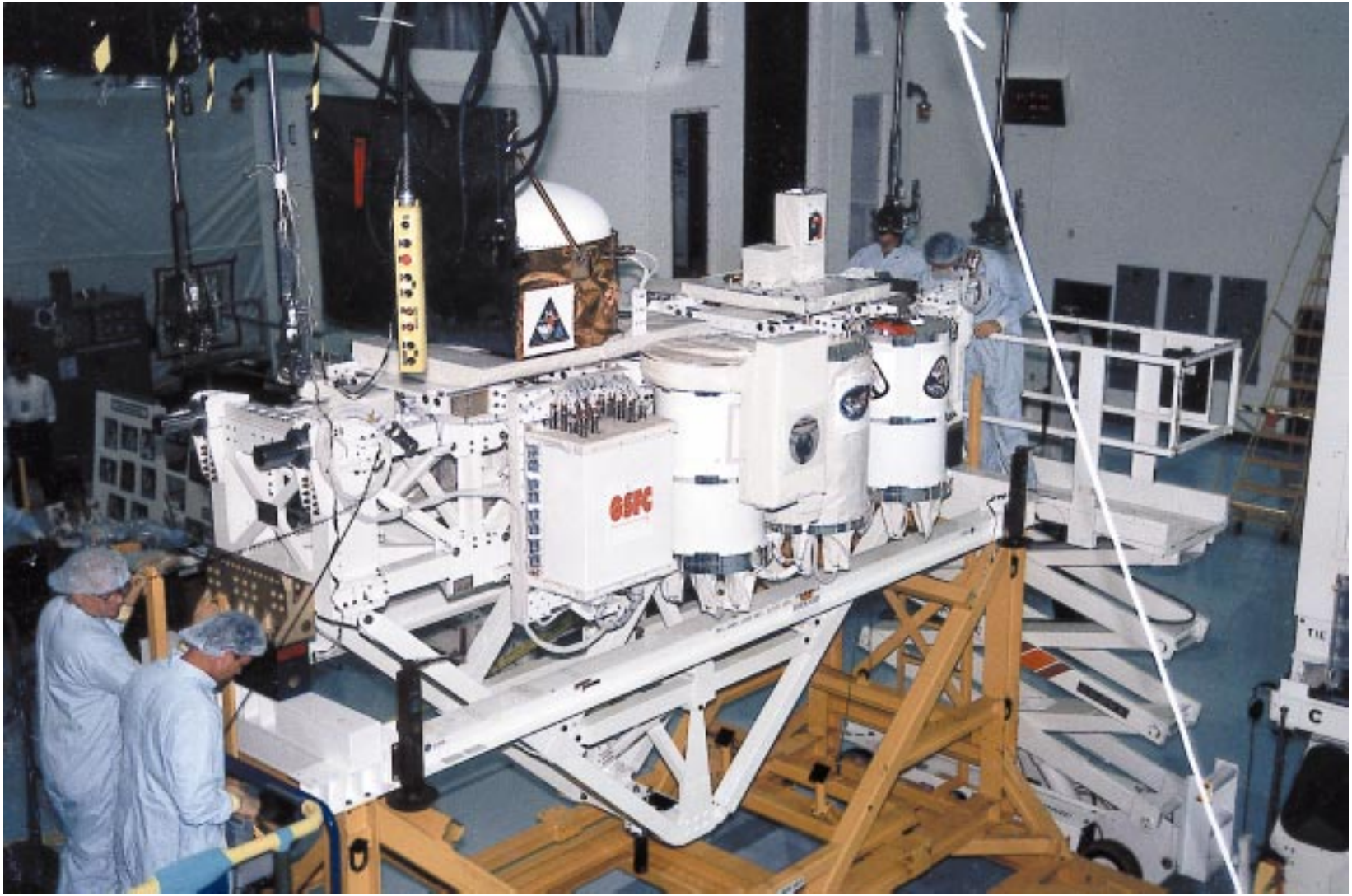
CRYOTSU, GAS-779, and GAS-467 on STS-95, October 29, 1998

MightySat-I, STS-88, December 21, 1999

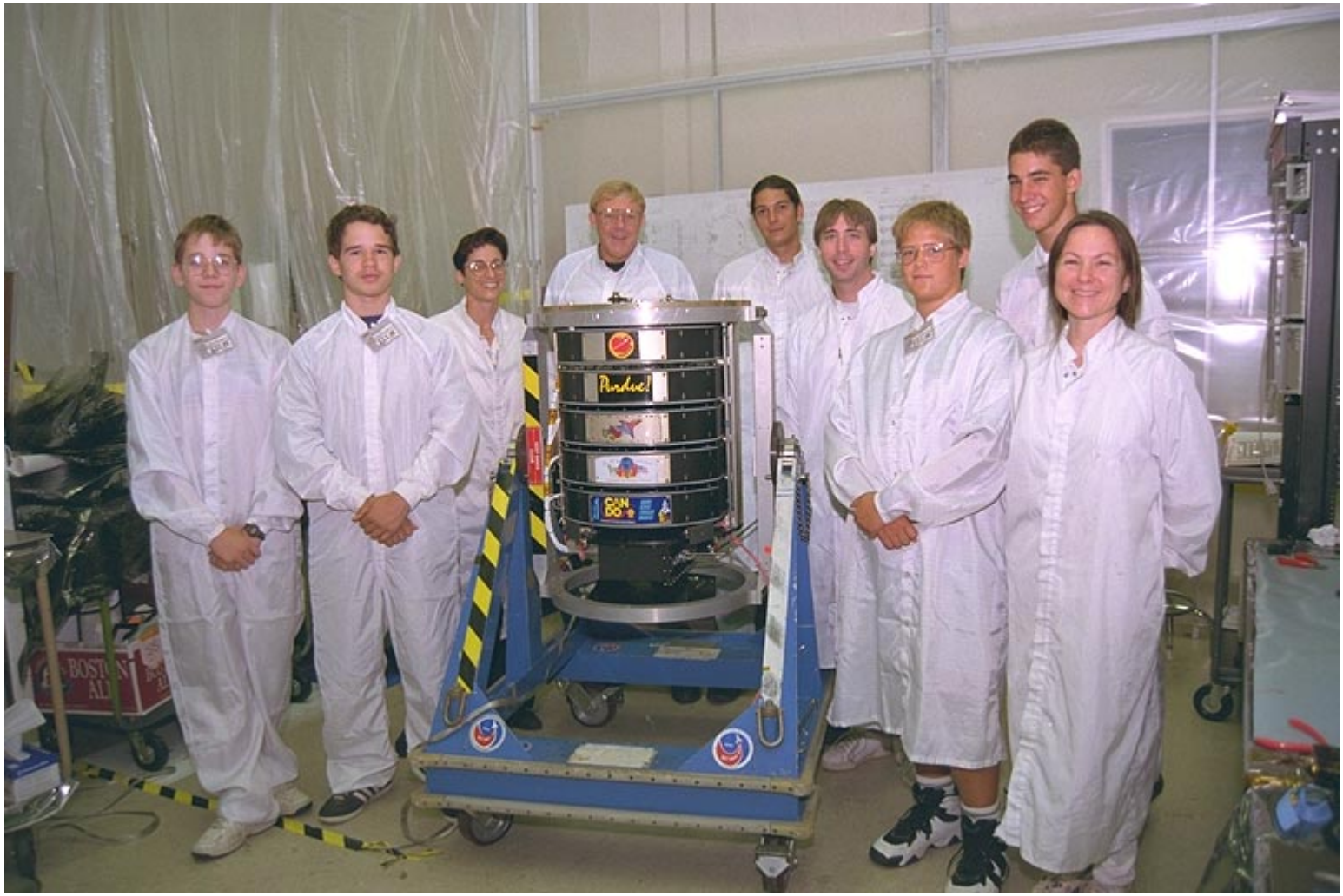
PAMS, STS-77, May 19, 1996

SAC-A, STS-88, December 4, 1998

TAS-01, STS-85, August 7, 1997

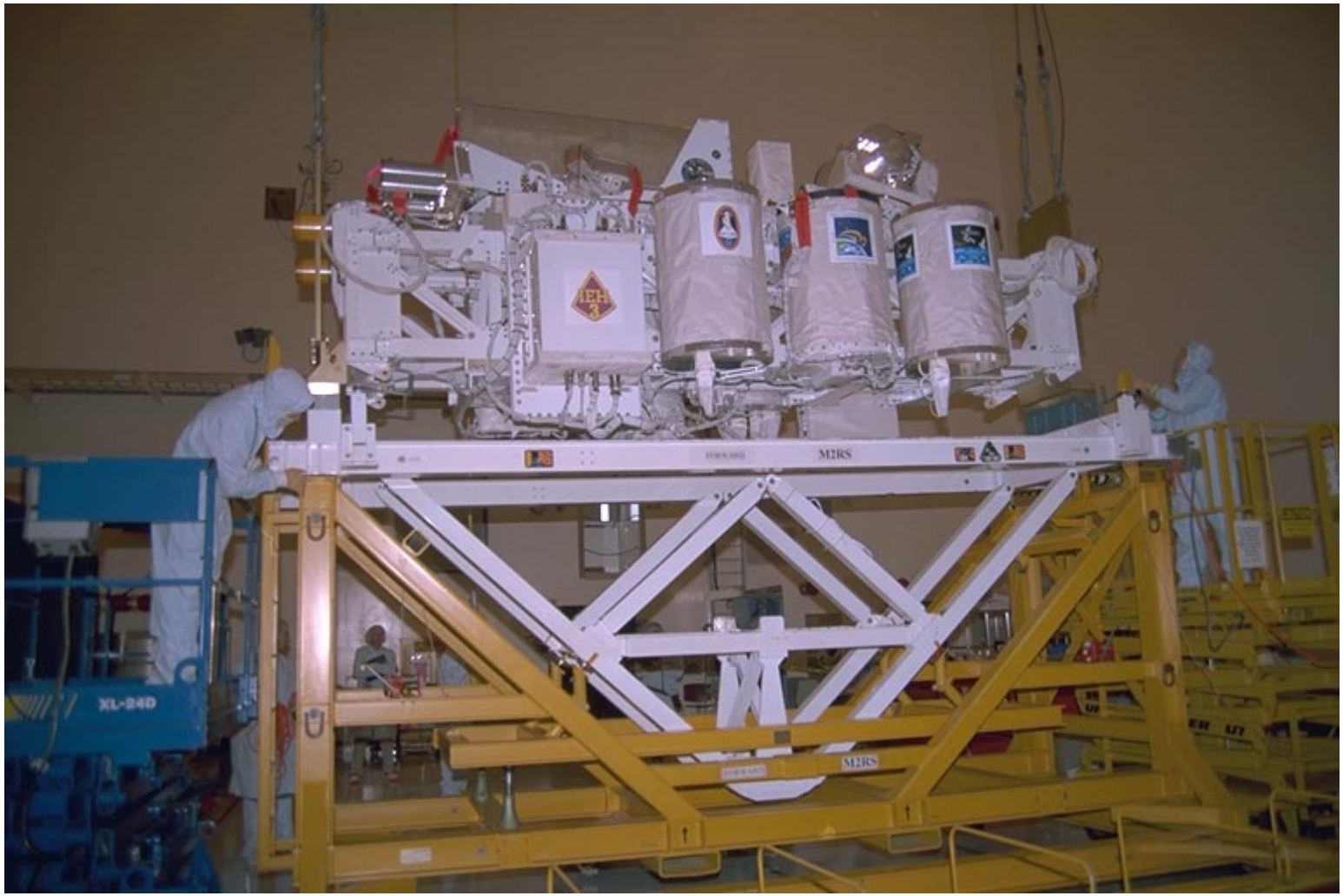


SEM-01, STS-80, November 19, 1996



Passive and Active SEM Experiments

GAS-238 and GAS-764 Experiments on IEH-3 Bridge



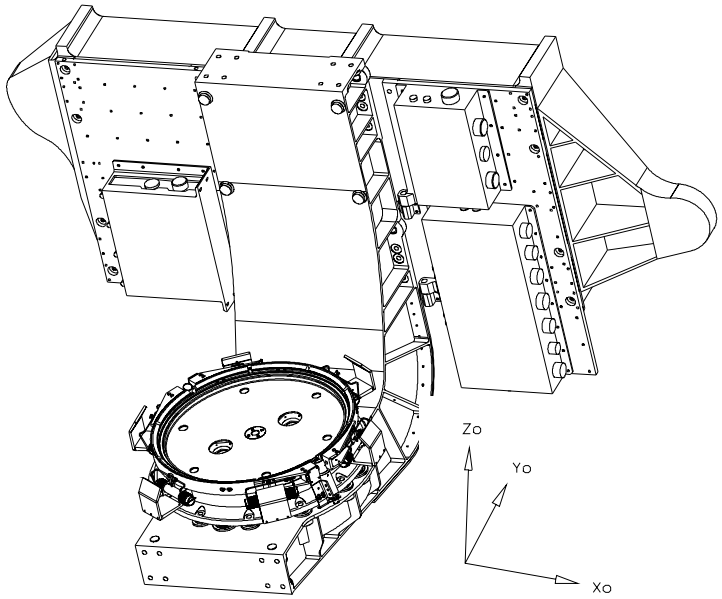
Future Enhancements

Future Enhancements

- ***Advanced Carrier Electronics (ACE)***
  - Supports up to 61 experiments
  - Supports PDI data rate: 8, 16, 32 Kbit/sec (configurable during mission)
  - Supports medium rate data up to 1.8 Mbit/sec
  - Provides system redundancy
  - Provides time tagged command / pre-stored command capabilities

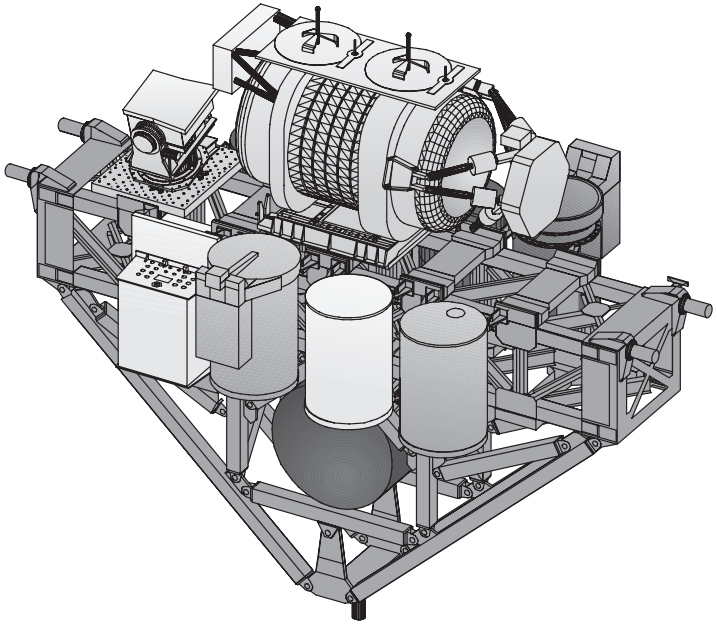
Future Enhancements

- ***Shuttle Hitchhiker Experiment Launch System (SHELS)***
  - Co-sponsored development by NASA/GSFC Explorer Project and DoD (USAF SMSC/OL-AW)
  - Flight Ready by January 2001
  - Side-mounting shelf designed to eject up to a 400 lb. (maximum) satellite from the Shuttle Payload Bay
  - Center of gravity 24 inches above the separation plane; +/- 0.25 inches off ejection axis centerline
  - Payload envelope:
    - 42.0” (orbiter +/-x)
    - 26.0” (orbiter +/-y)
    - 45.0” (orbiter +/-z)
  - Power and data umbilical available (optional cost)
  - 280 Watts radiated heater power if no umbilical



Future Enhancements

- ***International Space Station (ISS) Hitchhiker External Attached Payload Concepts***
  - ISS will be able to accommodate carriers such as Hitchhiker and GAS
  - SSPP concept provides carrier systems with standard Hitchhiker-type interfaces to allow flight of existing instruments
  - Carrier system to be accommodated on Express Pallet, Japanese Experiment Module, and other mounting options to be determined



SSPP Website Address

There is more information at the SSPP Website:

http://sspp.gsfc.nasa.gov